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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| *Office Action Summary* | **Application No.** | **Applicant(s)** | |
|---|---|---|---|
| | 10/791,258 | LUO ET AL. | |
| | **Examiner** | **Art Unit** | |
| | EDWARD PARK | 2624 | |

***-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --***

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on 23 May 2008.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) 1-31 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) 1-31 is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Continued Examination Under 37 CFR 1.114*

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 5/23/08 has been entered.

2. The declaration filed on 5/23/08 under 37 CFR 1.132 is sufficient to overcome the Wallace et al reference (US 2004/0240706).

### *Claim Rejections - 35 USC § 102*

3. In response to applicant's declaration under 37 CFR 1.132, the previous claim rejection is withdrawn.

### *Claim Rejections - 35 USC § 103*

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. **Claims 1-5, 11, 12, 17-19** are rejected under 35 U.S.C. 103(a) as being unpatentable over Owechko et al (US 6,801,662 B1) in view of Gokturk et al (US 2004/0153229 A1).

Regarding **claim 1**, Owechko teaches an apparatus for tracking at least one head candidate, said apparatus comprising:

an image analyzer for analyzing an image signal ("recognizing the type of occupant and his position by combining different types of information extracted from a video stream generated by an imaging sensor"; Owechko: col. 2, lines 44-47) to identify at least one of a plurality of possible new head candidates within an area of interest and for providing data related to the identified at least one head candidate ("classifying the image features to produce object class confidence data; and performing data fusion on the object class confidence data to produce a detected object estimate; Owechko: col. 2, lines 61-65); and

a tracking system that stores location information for at least one tracked head candidate ("coordinated are updated by estimating the centroid rectangle equivalent to the thresholded motion image computed in the region"; Owechko: col. 8, lines 8-20).

Owechko does not teach a candidate matcher that predicts the current position of a given tracked head candidate from the previous position and motion of the head to provide a projected head candidate position, selects a subset of the at least one of the plurality of possible new head candidates according to their distance from the predicted position, and evaluates the similarity of each member of the selected subset to the tracked candidate to determine if a new head candidate within the selected subset represents a current position of the tracked head candidate.

Gokturk, in the same field of “intelligent deployment and use of airbags” (Gokturk: paragraph [0002]), teaches a candidate matcher that predicts the current position of a given tracked head candidate from the previous position and motion of the head to provide a projected head candidate position (“head-tracking algorithm is to determine the location of the head in the current frame given the location and the shape in the previous frame”; “changes and motions in the scene can be modeled and analyzed with two different purposes: distinguish occupant motions from variations of coordinates and shapes that may occur as a consequence of sensing errors and occupant motions can be classified in order to distinguish animate from inanimate occupants”; Gokturk: paragraph [0151], [0138]), selects a subset of the at least one of the plurality of possible new head candidates according to their distance from the predicted position (Gokturk: paragraph [0149]), and evaluates the similarity of each member of the selected subset to the tracked candidate to determine if a new head candidate within the selected subset represents a current position of the tracked head candidate (“the head is re-detected periodically (every few seconds to make sure another occupant does not appear in the scene))”; Gokturk: paragraph [0154]).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Owechko reference to utilize the candidate matcher of Gokturk, in order to correct “head tracking algorithms [that] lose track [of the head location] due to abrupt head movements, or abrupt environmental changes” (Gokturk: paragraph [0151]).

Regarding **claim 2**, Owechko discloses an image source that provides the image signal to the image analyzer (“means for capturing images of an area may comprise CMOS or CCD

cameras or other devices known in the art that allow digital images of a viewed area to be captured"; Owechko: col. 3, lines 9-13).

Regarding **claim 3**, Owechko discloses wherein the image source includes a stereo camera ("stereo imaging system…deploying two vision sensors at a fixed distance apart"; Owechko: col. 7, lines 58-60).

Regarding **claim 4**, Owechko discloses wherein the candidate matcher updates the location information at the tracking system according to the determined matches ("coordinates are updated by estimating the centroid of the rectangle equivalent to the thresholded motion image computed in the region"; Owechko: col. 8, lines 14-20).

Regarding **claim 5**, Owechko discloses wherein a confidence value associated with the given tracked candidate is updated at the tracking system according to the evaluation of the candidate matcher ("each classifier generates a class predication and confidence value"; Owechko: col. 4, lines 53-54).

Regarding **claim 11 and 12**, Owechko discloses all elements as applied to claim 1 above.

Owechko does not teach wherein the image analyzer includes means for performing a head candidate algorithm using the image signal to identify the at least one of the plurality of possible new head candidates in the area of interest and means for determining the position of the at least one of the plurality of possible new head candidates.

Gokturk teaches wherein the image analyzer includes means for performing a head candidate algorithm using the image signal to identify the at least one of the plurality of possible new head candidates in the area of interest ("various algorithms exist for the detection of heads"; Gokturk: paragraph [0149]) and means for determining the position of the at least one of the

plurality of possible new head candidates ("head-tracking uses the location and shape information from a previous frame"; Gokturk: paragraph [0151]).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Owechko reference to utilize head candidate algorithm of Gokturk, in order to effectively deploy or not deploy an airbag depending on an occupant's head which is "one of the more easy features of a person to track" (Gokturk: paragraph [0149]).

Regarding **claim 17**, Owechko discloses wherein said means for performing the head candidate algorithm includes means for determining at least one of a 3D spherical shape head candidate, a contour based head candidate, and a motion based head candidate from the image signal ("estimating the motion inside a rectangular region of interest"; Owechko: col. 8, lines 8-9).

Regarding **claim 18**, Owechko discloses an air bag and means for controlling the air bag in response to the current position of the at least one tracked head candidate ("enable/disable commands to airbag deployment systems"; Owechko: col. 3, lines 50-54).

Regarding **claim 19**, Owechko teaches an air bag restraining system for helping to protect an occupant of a vehicle upon the occurrence of a vehicle crash event, said apparatus comprising:

an air bag restraining device for, when actuated, helping to protect the vehicle occupant ("airbag deployment system should be triggered or not"; Owechko: col. 2, lines 30);

a stereo vision system for imaging an interior area of the vehicle and providing an image signal of the area of interest ("stereo image system"; Owechko: col. 7, line 38);

an image analyzer for analyzing the image signal ("recognizing the type of occupant position by combining different types of information extracted from a video generated by an

imaging sensor"; Owechko: col. 2, lines 44-47) to identify at least one of a plurality of possible new head candidates within an area of interest and for providing data related to the identified at least one head candidate ("classifying the image features to produce object class confidence data; and performing data fusion on the object class confidence data to produce a detected object estimate"; Owechko: col. 2, lines 61-65); and

a tracking system that stores location information for at least one tracked head candidate ("coordinates are updated by estimating the centroid of the rectangle equivalent to the thresholded motion image computed in the region"; Owechko: col. 8, lines 8-20).

Owechko does not teach:

crash sensor for sensing a vehicle crash event and, when a crash event occurs, providing a crash signal;

an air bag controller for monitoring the crash sensor and controlling actuation of the air bag restraining device;

a candidate matcher that predicts the current position of a given tracked head candidate, selects a subset of the identified at least one of a plurality of possible new head candidates according to their distance from the predicted position, evaluates the similarity of each member of the selected subset to the tracked candidate to determine if a new head candidate within the selected subset represents a current position of the tracked head candidate, and provides a signal to the air bag controller indicating the current position of each of the at least one tracked head candidates;

the air bag controller controlling actuation of the air bag restraining device in response to both the crash signal and the current position of the at least one tracked head candidate.

Gokturk, in the same field of “intelligent deployment and use of airbags” (Gokturk: paragraph [0002]), teaches:

crash sensor for sensing a vehicle crash event and, when a crash event occurs, providing a crash signal (“determination is made as to weather an event has occurred in which the airbag is to be deployed …. crash sensor”; Gokturk: paragraph [0049]);

an air bag controller for monitoring the crash sensor and controlling actuation of the air bag restraining device (“control data for deploying the airbag is determined and outputted”; Gokturk: paragraph [0052]);

a candidate matcher that predicts the current position of a given tracked head candidate (“head-tracking algorithm is to determine the location of the head in the current frame given the location and the shape in the previous frame”; Gokturk: paragraph [0151], selects a subset of the at least one of the plurality of possible new head candidates according to their distance from the predicted position, and evaluates the similarity of each member of the selected subset to the tracked candidate to determine if a new head candidate within the selected subset represents a current position of the tracked head candidate (“the head is re-detected periodically (every few seconds to make sure another occupant does not appear in the scene))”; Gokturk: paragraph [0154]), and provides a signal to the air bag controller indicating the current position of each of the at least one tracked head candidates (“provides the position of the tracking feature is tracked”; Gokturk: paragraph [0051]);

the air bag controller controlling actuation of the air bag restraining device in response to both the crash signal and the current position of the at least one tracked head candidate (“control

data may be based at least in part on the position information determined in step 140"; Gokturk: paragraph [0052]).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Owechko reference to utilize the crash sensor, air bag controller, candidate matcher, and an air bag controller of Gokturk, in order for automated "decision on when an airbag is deployed, as well as the power level in which the airbag is deployed" to ensure the "safety and effectiveness of an airbag deployment system" (Gokturk: paragraph [0034]).

6. **Claims 6-10** are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Owechko et al (US 6,801,662 B1) with Gokturk et al (US 2004/0153229 A1) as applied to claim 1 above, and further in view of Gokturk03 et al (US 2003/0235341). (The Gokturk reference (US 2003/0235341) will be referred to as Gokturk03).

Regarding **claim 6**, Owechko and Gokturk combination discloses all elements as applied to claim 1 above.

The Owechko and Gokturk does not teach wherein the candidate matcher selects a predetermined number of the identified at least one of a plurality of possible new head candidates that are closest to the predicted location.

Gokturk03 teaches wherein the candidate matcher selects a predetermined number of the identified at least one of a plurality of possible new head candidates that are closest to the predicted location ("new search space [for head candidate] can be defined as a band around the ellipse of the pervious frame … the width of this band can be between 10 to 100 pixels depending on the resolution of the image"; Gokturk03: paragraph [0060]).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Owechko and Gokturk combination to utilize a candidate matcher that selects a head candidate near the predicted location of Gokturk03, in order for faster, efficient tracking of the head candidate since "the search space is around the detected head, as opposed to the full image" (Gokturk03: paragraph [0060]).

Regarding **claim 7**, Owechko and Gokturk combination discloses all elements as applied to claim 1 above.

Owechko and Gokturk combination does not teach wherein the candidate matcher determines at least one threshold distance based on the projected location and selects all of the identified at least one of a plurality of possible new head candidates falling within a selected one of the determined at least one threshold distance.

Gokturk03 teaches wherein the candidate matcher determines at least one threshold distance based on the projected location and selects all of the identified at least one of a plurality of possible new head candidates falling within a selected one of the determined at least one threshold distance ("new search space [for head candidate] can be defined as a band around the ellipse of the pervious frame … the width of this band can be between 10 to 100 pixels depending on the resolution of the image"; Gokturk03: paragraph [0060]).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Owechko and Gokturk combination to utilize a candidate matcher that determines a threshold distance of Gokturk03, in order for faster, efficient tracking of the head candidate since "the search space is around the detected head, as opposed to the full image" (Gokturk03: paragraph [0060]).

Regarding **claim 8**, Owechko and Gokturk combination discloses all elements as applied to claim 7 above.

The Owechko and Gokturk combination does not teach wherein a confidence value associated with the given tracked candidate is updated according to the position of the selected subset of the identified at least one of a plurality of possible head candidates relative to the at least one threshold distance and the evaluated similarity of identified at least one of a plurality of possible head candidates to the tracked candidate.

Gokturk03 teaches wherein a confidence value associated with the given tracked candidate is updated (see fig. 7, paragraph [0060]) according to the position of the selected subset of the identified at least one of a plurality of possible head candidates relative to the at least one threshold distance and the evaluated similarity of identified at least one of a plurality of possible head candidates to the tracked candidate ("new search space [for head candidate] can be defined as a band around the ellipse of the pervious frame … the width of this band can be between 10 to 100 pixels depending on the resolution of the image"; Gokturk03: paragraph [0060]).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Owechko and Gokturk combination to utilize a position of the selected subset to update the confidence value of Gokturk, in order for increased accuracy and efficiency in tracking the head candidate since "the search space is around the detected head, as opposed to the full image" (Gokturk03: paragraph [0060]).

Regarding **claims 9 and 10**, Owechko and Gokturk combination discloses all elements as applied to claim 1 above.

The Owechko and Gokturk combination does not teach wherein the candidate matcher matches a given tracked head candidate with one of the selected subset of the identified at least one of a plurality of possible new head candidates according to respective similarity scores associated with the subset of new head candidates, a given similarity score reflecting a degree to which an associated new head candidate resembles the tracked head candidate across at least one feature and similarity score is calculated by a pattern recognition, classifier.

Gokturk03 teaches wherein the candidate matcher matches a given tracked head candidate with one of the selected subset of the identified at least one of a plurality of possible new head candidates according to respective similarity scores associated with the subset of new head candidates, a given similarity score reflecting a degree to which an associated new head candidate resembles the tracked head candidate across at least one feature ("once the edges are grouped according to a similarity measure, e.g., based on their depth or location, connected-component analysis is applied to each group of edges … cluster with the best ellipse fit is declared as the head", "edges of the depth image"; Gokturk03: [0057]) and similarity score is calculated by a pattern recognition, classifier ("classifier function"; Gokturk03: [0059]).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Owechko and Gokturk combination to utilize a candidate matcher that matches a given tracked head candidate by similarity scores of Gokturk03, in order for increased accuracy and efficiency in tracking the tracked head candidate in the midst of a non-head candidates with similar elliptical features.

7. **Claim 13** is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Owechko et al (US 6,801,662 B1), Gokturk et al (US 2004/0153229 A1), Gokturk03 et al (US 2003/0235341) as applied to claim 11 above, and further in view of Guthrie (US 5,973,732).

Regarding **claim 13**, Owechko, Gokturk, and Gokturk03 combination discloses all elements as applied to claim 11 above.

The Owechko, Gokturk, and Gokturk03 combination does not teach wherein the means for performing the head candidate algorithm includes first determining means for determining a blob image from the image signal.

Guthrie teaches wherein the means for performing the head candidate algorithm includes first determining means for determining a blob image from the image signal ("”blob analysis””; Guthrie: col. 3, lines 26-27).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Owechko, Gokturk, and Gokturk03 combination to utilize a blob image of Guthrie, in order for "better detection is achieved" (Guthrie: col. 2, lines 65-66) which allows for more efficient and accurate head tracking means.

8. **Claims 14-16** are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Owechko et al (US 6,801,662 B1), Gokturk et al (US 2004/0153229 A1), Gokturk03 et al (US 2003/0235341), Guthrie (US 5,973,732) as applied to claim 11 above, and further in view of Takagi et al (US 7,134,688 B2).

Regarding **claims 14-16**, Owechko, Gokturk, Gokturk03, Guthrie combination discloses all elements as applied to claim 13 above.

The Owechko, Gokturk, Gokturk03, Guthrie combination does not teach:

wherein said means for performing the head candidate algorithm further includes second determining means for determining a contour of the blob image and establishing a contour image in response thereto;

wherein said means for performing the head candidate algorithm further includes third determining means for determining turning point locations of the contour image; and

wherein said means for performing the head candidate algorithm further includes means for performing an ellipse fitting algorithm for determining the quality of ellipse fits of the contour image between determined turning point locations.

Takagi teaches:

wherein said means for performing the head candidate algorithm further includes second determining means for determining a contour of the blob image and establishing a contour image in response thereto ("passenger information is determined by comparing the closed outlines extracted from the picked-up image", "passenger's head is extracted on the basis of the outlines of the passenger's head"; Takagi: col. 1, lines 45-51);

wherein said means for performing the head candidate algorithm further includes third determining means for determining turning point locations of the contour image ("elliptic boundaries are extracted among the boundaries … the elliptic boundaries are determined by curvature changes along a boundary, or by a change in distances between a center of the points on the boundary"; Takagi: col. 3, lines 34-44); and

wherein said means for performing the head candidate algorithm further includes means for performing an ellipse fitting algorithm for determining the quality of ellipse fits of the contour image between determined turning point locations ("curvature of the boundary can be

detected by coordinates of three points distant by a prescribed distance with each other", "ellipse shape of the detected head ellipse is such that the shape may belong to a shape range of reference ellipses stored beforehand"; Takagi: col. 3, lines 44-64).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Owechko, Gokturk, and Gokturk03, Guthrie combination to determine a contour of the blob image, a turning point, and quality of ellipse of Takagi, in order to "[reduce] image processing time period and improving an accuracy of the passenger determination" by allowing the "load for image processing for extracting the head ellipse [to be] low" (Takagi: col. 1, lines 56-59), therefore allows head candidates to be "easily detected" (Takagi: col. 3, lines 37-38).

9. **Claims 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, and 30**are rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Owechko et al (US 6,801,662 B1) with Gokturk et al (US 2004/0153229 A1), and further in view of Gokturk03 et al (US 2003/0235341). (The Gokturk reference (US 2003/0235341) will be referred to as Gokturk03).

Regarding **claim 20**, Owechko teaches a head candidate matching method for determining a current location of a previous head candidate, the method comprising the steps of:

imaging a class object and providing an image signal of an area of interest ("means for capturing images of an area occupied by at least one object"; Owechko: col. 3, lines 4-5);

Owechko does not teach:

identifying at least one of a plurality of possible new head candidates and associated location data from the image signal;

predicting the current location of the previous head candidate according to its previous location and motion;

selecting a subset of the identified at least one of the plurality of possible new head candidates based on the distance of each of the identified at least one of the plurality of possible new head candidates from the predicted location; and

comparing each of the selected subset of new head candidates to the previous head candidate across at least one feature.

Gokturk teaches identifying at least one of a plurality of possible new head candidates and associated location data from the image signal; predicting the current location of the previous head candidate according to its previous location and motion ("head-tracking algorithm is to determine the location of the head in the current frame given the location and the shape in the previous frame", "the head is re-detected periodically (every few seconds to make sure another occupant does not appear in the scene)", "changes and motions in the scene can be modeled and analyzed with two different purposes: distinguish occupant motions from variations of coordinates and shapes that may occur as a consequence of sensing errors and occupant motions can be classified in order to distinguish animate from inanimate occupants"; Gokturk: paragraph [0151], [0154], [0138]).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Owechko reference to identify a new head candidate and predict the current location of Gokturk, in order to correct "head tracking algorithms [that] lose track [of the head location] due to abrupt head movements, or abrupt environmental changes" (Gokturk: paragraph

[0151]) which leads to an increase in accuracy and safety for the occupant in an event of an accident.

Gokturk03 teaches selecting a subset of the identified at least one of the plurality of possible new head candidates based on the distance of each of the identified at least one of the plurality of possible new head candidates from the predicted location (“new search space [for head candidate] can be defined as a band around the ellipse of the previous frame … the width of this band can be between 10 to 100 pixels depending on the resolution of the image… the edges”; Gokturk03: paragraph [0060]) and comparing each of the selected subset of new head candidates to the previous head candidate across at least one feature (“checking if the ellipse is a good fit with a small residue, and also comparing its size to the head size determined in detection”; Gokturk03: paragraph [0060]).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Owechko with Gokturk combination as stated above, to select a subset of new head candidates based on distance and compare to a previous frame of Gokturk03, in order for increased accuracy and efficiency in tracking the head candidate since “the search space is around the detected head, as opposed to the full image” (Gokturk03: paragraph [0060]).

Regarding **claim 21**, Owechko teaches wherein the step of imaging a class object includes using a stereo camera (“stereo imaging system…deploying two vision sensors at a fixed distance apart”; Owechko: col. 7, lines 58-60).

Regarding **claims 22, 23, 24, 25, 26, 27, 28, 29**, the Owechko, Gokturk, and Gokturk03 combination discloses all elements as applied to claim 20.

The Owechko, Gokturk, and Gokturk03 combination as applied to claim 20 does not teach:

wherein selecting a subset of the identified at least one of a plurality of possible new head candidates includes selecting a predetermined number of the identified at least one of a plurality of possible new head candidates that are closest to the predicted location;

wherein selecting a subset of the identified at least one of a plurality of possible new head candidates includes establishing a threshold distance around the predicted location and selecting every new head candidate within the threshold distances;

wherein selecting a subset of the identified at least one of a plurality of possible new head candidates includes establishing a plurality of threshold distances around the predicted location and selecting every new head candidate within a selected one of the plurality of threshold distances;

selecting the smallest threshold distance encompassing at least one new head candidate;

updating a tracking confidence associated with the previous head candidate according to the selected threshold distance;

plurality of threshold distances comprising an inner threshold distance and an outer threshold distance and the method further comprising comparing a confidence value associated with a selected new head candidate to a threshold value only if the selected new head candidate falls between the inner threshold distance and the outer threshold distance;

wherein comparing the selected subset of new head candidates to the previous head candidate includes computing a similarity score for each selected new head candidate based

upon its similarity to the previous head candidate and identifying the new head candidate with the-best similarity score as the current location of the previous head candidate;

wherein computing the similarity score for a given new head candidate includes providing feature data associated with the new head candidate and feature data associated with the previous head candidate to a pattern recognition classifier.

Gokturk further teaches:

updating a tracking confidence associated with the previous head candidate according to the selected threshold distance ("system confidence is built up in the physical-even 1430 reasoning layer by accumulating the decisions from several frames"; Gokturk: paragraph [0154]);

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Owechko, Gokturk, Gokturk03 combination as applied to claim 20 to update a tracking confidence of Gokturk, in order for increased accuracy of position detection of the occupant, which translates to increase in safety for the driver/passenger in regards to airbag deployment.

Gokturk03 further teaches:

wherein selecting a subset of the identified at least one of a plurality of possible new head candidates includes selecting a predetermined number of the identified at least one of a plurality of possible new head candidates that are closest to the predicted location ("new search space [for head candidate] can be defined as a band around the ellipse of the previous frame … the width of this band can be between 10 to 100 pixels depending on the resolution of the image… the edges"; Gokturk03: paragraph [0060]);

wherein selecting a subset of the identified at least one of a plurality of possible new head candidates includes establishing a threshold distance around the predicted location and selecting every new head candidate within the threshold distances ("new search space [for head candidate] can be defined as a band around the ellipse of the previous frame … the width of this band can be between 10 to 100 pixels depending on the resolution of the image… the edges"; Gokturk03: paragraph [0060]);

wherein selecting a subset of the identified at least one of a plurality of possible new head candidates includes establishing a plurality of threshold distances around the predicted location and selecting every new head candidate within a selected one of the plurality of threshold distances ("new search space [for head candidate] can be defined as a band around the ellipse of the previous frame … the width of this band can be between 10 to 100 pixels depending on the resolution of the image… the edges"; Gokturk03: paragraph [0060]);

selecting the smallest threshold distance encompassing at least one new head candidate ("new search space [for head candidate] can be defined as a band around the ellipse of the previous frame … the width of this band can be between 10 to 100 pixels depending on the resolution of the image… the edges"; Gokturk03: paragraph [0060]);

plurality of threshold distances comprising an inner threshold distance and an outer threshold distance and the method further comprising comparing a confidence value associated with a selected new head candidate to a threshold value only if the selected new head candidate falls between the inner threshold distance and the outer threshold distance ("new search space [for head candidate] can be defined as a band around the ellipse of the previous frame … the

width of this band can be between 10 to 100 pixels depending on the resolution of the image… the edges"; Gokturk03: paragraph [0060]);

wherein comparing the selected subset of new head candidates to the previous head candidate includes computing a similarity score for each selected new head candidate based upon its similarity to the previous head candidate and identifying the new head candidate with the-best similarity score as the current location of the previous head candidate ("Once the edges are grouped according to a similarity measure, e.g, based on their depth or location, connected-component analysis is applied to each group of edges… cluster with the best ellipse fit is declared as the head"; Gokturk03: paragraph [0057]);

wherein computing the similarity score for a given new head candidate includes providing feature data associated with the new head candidate and feature data associated with the previous head candidate to a pattern recognition classifier ("edge values with similar depth values are grouped together", "evaluated until the algorithm finds the best-fit head"; Gokturk: paragraph [0057]).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Owechko, Gokturk, Gokturk03 combination as applied above to select a subset with a certain threshold distance, to elect the best similarity score, and utilize a pattern recognition classifier of Gokturk03, in order for faster, efficient tracking of the head candidate since "the search space is around the detected head, as opposed to the full image" (Gokturk03: paragraph [0060]) with increased accuracy, detection, and tracking of the occupant's head in the midst of non-head candidates with elliptical features.

Regarding **claim 30**, Owechko teaches a method for tracking a previously identified head candidate, comprising an imaging a class object and providing an image signal of an area of interest ("means for capturing images of an area occupied by at least one object"; Owechko: col. 3, lines 4-5).

Owechko does not teach:

identifying at least one of a plurality of possible new head candidates and associated location data from the image signal;

predicting the current location of the previous head candidate according to its previous location and motion;

defining at least one threshold distance around the predicted location; and

updating a tracking confidence value associated with the previously identified head candidate according to respective positions of the identified at least one of the plurality of new head candidates relative to the at least one defined threshold distance.

Gokturk teaches:

identifying at least one of a plurality of possible new head candidates and associated location data from the image signal; predicting the current location of the previous head candidate according to its previous location and motion ("head-tracking algorithm is to determine the location of the head in the current frame given the location and the shape in the previous frame", "the head is re-detected periodically (every few seconds to make sure another occupant does not appear in the scene)", "changes and motions in the scene can be modeled and analyzed with two different purposes: distinguish occupant motions from variations of coordinates and shapes that may occur as a consequence of sensing errors and occupant motions

can be classified in order to distinguish animate from inanimate occupants"; Gokturk: paragraphs [0151], [0154],[0138]); and

updating a tracking confidence value associated with the previously identified head candidate according to respective positions of the identified at least one of the plurality of new head candidates relative to the at least one defined threshold distance ("system confidence is built up in the physical-even 1430 reasoning layer by accumulating the decisions from several frames"; Gokturk: paragraph [0154]).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Owechko reference to identify a new head candidate, predict the current position, and update the tracking confidence value as suggested by Gokturk, in order to correct "head tracking algorithms [that] lose track [of the head location] due to abrupt head movements, or abrupt environmental changes" (Gokturk: paragraph [0151]) which leads to an increase in accuracy and safety for the occupant in an event of an accident.

Gokturk03 teaches defining at least one threshold distance around the predicted location ("new search space [for head candidate] can be defined as a band around the ellipse of the previous frame … the width of this band can be between 10 to 100 pixels depending on the resolution of the image… the edges"; Gokturk03: paragraph [0060]).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Owechko with Gokturk combination as applied above to define the threshold distance as suggested by Gokturk03, in order to for faster, efficient tracking of the head candidate since "the search space is around the detected head, as opposed to the full image"

(Gokturk03: paragraph [0060]) with increased accuracy, detection, and tracking of the occupant's head in the midst of non-head candidates with elliptical features.

10. **Claim 31** is rejected under 35 U.S.C. 103(a) as being unpatentable over the combination of Owechko et al (US 6,801,662 B1), Gokturk et al (US 2004/0153229 A1), Gokturk03 et al (US 2003/0235341), and further in view of Guthrie (US 5,973,732). (The Gokturk reference (US 2003/0235341) will be referred to as Gokturk03).

Regarding **claim 31**, the Owechko, Gokturk, Gokturk03 combination discloses all elements as applied to claim 30 above.

Owechko, Gokturk, Gokturk03 combination does not teach wherein updating the tracking confidence value includes decreasing the tracking confidence value when no identified new head candidate is encompassed by a selected one of the defined at least one threshold distance.

Guthrie teaches wherein updating the tracking confidence value includes decreasing the tracking confidence value when no identified new head candidate is encompassed by a selected one of the defined at least one threshold distance ("when an object can no longer be tracked, the system allows the persistence value to decrease to zero and then evaluates the progress of that object"; Guthrie: col. 7, lines 31-39).

It would have been obvious at the time the invention was made to one of ordinary skill in the art to modify the Owechko, Gokturk, Gokturk03 combination as applied in claim 30 to decrease the tracking confidence value as suggested by Guthrie, in order to "track [the] object for as long as possible" (Guthrie: col. 7, lines 31-39) without compromising the accuracy of the head tracking system and which ensures that the tracked object is an actual head candidate.

***Response to Arguments***

11. Applicant's arguments filed on 5/23/08, in regards to **claims 1 and 19**, have been fully considered but they are not persuasive. Applicant argues that the Gorturk reference does not disclose or suggest predicating a candidate location from the previous position and motion of the head as recited in claims 1 and 19 (see pg. 13 first paragraph). This argument is not considered persuasive since Gorturk does disclose predicting from the previous motion of the head in Gokturk (paragraph [0138]) where "changes and motions in the scene can be modeled and analyzed with two different purposes: distinguish occupant motions from variations of coordinates and shapes that may occur as a consequence of sensing errors and occupant motions can be classified in order to distinguish animate from inanimate occupants".

Regarding claim 19, in response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., predicating a candidate location from the previous position and motion of the head) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Examiner notes that claim 19 does not claim the motion of the head.

Applicant argues that Gorturk does not teach evaluating the selected subset (see pg. 13, second paragraph). This argument is not considered persuasive since the applicant admits that in Gokturk, all head candidates within the search space are evaluated and therefore, therefore there is no existing plurality of identified head candidates from which to select a subset as recited in

claim 1 (see pg. 13, second paragraph). It is clear to one ordinary skilled in the art that a subset could be one candidate of a set, some candidates of the set, or the entire set altogether. Therefore, the applicant admits that the claim limitation is met by Gorturk by admitting that Gokturk evaluates all head candidates within the search space as oppose to a subset of the head candidates, since a subset can be considered to be the entire set itself.

Applicant argues that the Gokturk reference does not teach selecting a subset of the at least one of the plurality of possible new head candidates according to their distance from the projected head candidate position (see pg. 14, first paragraph). This argument is not considered persuasive since Gokturk (paragraph [0149]) discloses plurality of possible new head candidates through “depth-based algorithm [that utilizes] ellipsoid model in three-dimensions or two-dimension [in order to utilize] edge values with similar depth values are grouped together and an ellipse is fit". The selecting a subset of the candidates according to their distance from the projected head candidate position is seen in Gokturk (paragraph [0151]) where head-tracking algorithms is utilized to determine the location of the head in the current frame given the location and the shape in the previous frame. The location and distance are equivalent since the position of the head can not be determined/predicted without the distance that the head relocated from one frame to another.

Furthermore, the applicant argues that Gokturk does not teach a candidate matcher that predicts the current position of a prior head candidate and selects head candidates according to their distance from the predicted location (see pg. 14, first paragraph). In response to applicant's argument that the references fail to show certain features of applicant’s invention, it is noted that the features upon which applicant relies (i.e., a candidate matcher that predicts the current

position of a prior head candidate and selects head candidates according to their distance from the predicted location) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Examiner notes that the claim language mentioned above changes the scope of claim 1.

Applicant argues one skilled in the art would have no reason to modify Owechko in view of Gokturk (see pg. 14, second paragraph). Applicant states that the motivation to modify Owechko in view of Gokturk is to allow for head tracking in Owechko as seen in the Final Office Action. In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, these arguments are not considered persuasive since the motivation to combine Gokturk with Owechko is to correct “head tracking algorithms [that] lose track [of the head location] due to abrupt head movements, or abrupt environmental changes” (Gokturk: paragraph [0151]).

Regarding **claims 2-5, 11, 12, 17, 18**, applicant argues that these claims are allowable due to the dependency from claim 1 (see pg. 15, second paragraph). This argument is not considered persuasive since the rejection of claim 1 stands and the arguments and rejection can be seen above.

Regarding **claim 19**, applicant argues that the claim is allowable for the same reasons for claim 1 (see pg. 15, second paragraph). This argument is not considered persuasive since the rejection of claim 1 stands and the arguments and rejection can be seen above.

Regarding **claims 6-10**, applicant argues that the examiner mischaracterized applicant's arguments by stating that applicants have argued that claims 6-10 are patentable because Gokturk03 fails to teach all of the limitations of claim 1 (see pg. 15, last paragraph). Applicant further states that it is the combination of Owechko in view of Gokturk that teaches all the limitations of claim 1 and that Gokturk03 does not remedy these deficiencies and furthermore claims 6-10 are allowable due to the dependency on claim 1 (see pg. 16, first paragraph). Regardless, of the prior office action stating that Gokturk03 fails to teach all of the limitations of claim 1, these arguments are not considered persuasive since the rejection of claim 1 stands and the arguments and rejection can be seen above.

Applicant's arguments with respect to **claim 8** have been considered but are moot in view of the new ground(s) of rejection (see pg. 16, second paragraph).

Regarding **claim 13**, applicant argues that these claims are allowable due to the dependency from claim 1 (see pg. 17, second paragraph). This argument is not considered persuasive since the rejection of claim 1 stands and the arguments and rejection can be seen above.

Regarding **claim 14-16**, applicant argues that these claims are allowable due to the dependency from claim 1 (see pg. 17, third paragraph). This argument is not considered persuasive since the rejection of claim 1 stands and the arguments and rejection can be seen above.

Regarding **claims 20 and 30**, applicant argues that these claims are allowable due to the same reasons from claim 1 (see pg. 18, first paragraph). This argument is not considered persuasive since the rejection of claim 1 stands and the arguments and rejection can be seen above. Furthermore, the applicant argues that there is no teaching of the previous motion of the head whatsoever in searching for the new head candidate (see pg. 18, first paragraph). This argument is not considered persuasive since the Gokturk reference discloses previous motion of the head in searching for the new head candidate in Gokturk (paragraph [0138]) where changes and motions in the scene can be modeled and analyzed with two different purposes: distinguish occupant motions from variations of coordinates and shapes that may occur as a consequence of sensing errors and occupant motions can be classified in order to distinguish animate from inanimate occupants.

Regarding **claim 27**, applicant argues that Gokturk03 does not teach the claim limitations of claim 27 (see pg. 18, second paragraph). This argument is not considered persuasive since Gokturk03 (paragraph [0060]) discloses a new search space [for head candidate] can be defined as a band around the ellipse of the previous frame … the width of this band can be between 10 to 100 pixels depending on the resolution of the image… the edges. The plurality of threshold distances comprising an inner threshold distance and an outer threshold distance is equivalent to the width of this band can be between 10 to 100 pixels depending on the resolution of the image. Comparing a confidence value associated with a selected new head candidate to a threshold value is equivalent determining if the new ellipse is a good fit by checking if the ellipse is a good fit with a small residue. Only if the selected new head candidate falls between the inner

threshold distance and the outer threshold distance is equivalent to new search space for head candidate] can be defined as a band around the ellipse of the previous frame.

Regarding **claims 21-29**, applicant argues that these claims are allowable due to the dependency from claim 20 (see pg. 18, last paragraph). This argument is not considered persuasive since the rejection of claim 20 stands and the arguments and rejection can be seen above.

Regarding **claims 31**, applicant argues that these claims are allowable due to the dependency from claim 30 (see pg. 19, second paragraph). This argument is not considered persuasive since the rejection of claim 30 stands and the arguments and rejection can be seen above.

## ***Conclusion***

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to EDWARD PARK whose telephone number is (571)270-1576. The examiner can normally be reached on M-F 10:30 - 20:00, (EST).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikkram Bali can be reached on (571) 272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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